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Uintah County, Utah

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Prepared for

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NATIONAL EUTROPHICATION SURVEY

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ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

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REPORT
ON
PELICAN LAKE
UINTAH COUNTY
UTAH
EPA REGION VIII
WORKING PAPER No. 852

WITH THE COOPERATION OF THE
UTAH STATE DIVISION OF HEALTH
AND THE
UTAH NATIONAL GUARD
OCTOBER, 1977

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Utah Department of Social Services and the Utah Department of Natural Resources for professional involvement, to the Utah National Guard for conducting the tributary sampling phase of the Survey, and to those Utah wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staffs of the Bureau of Water Quality of the Division of Health and the Division of Wildlife Resources provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

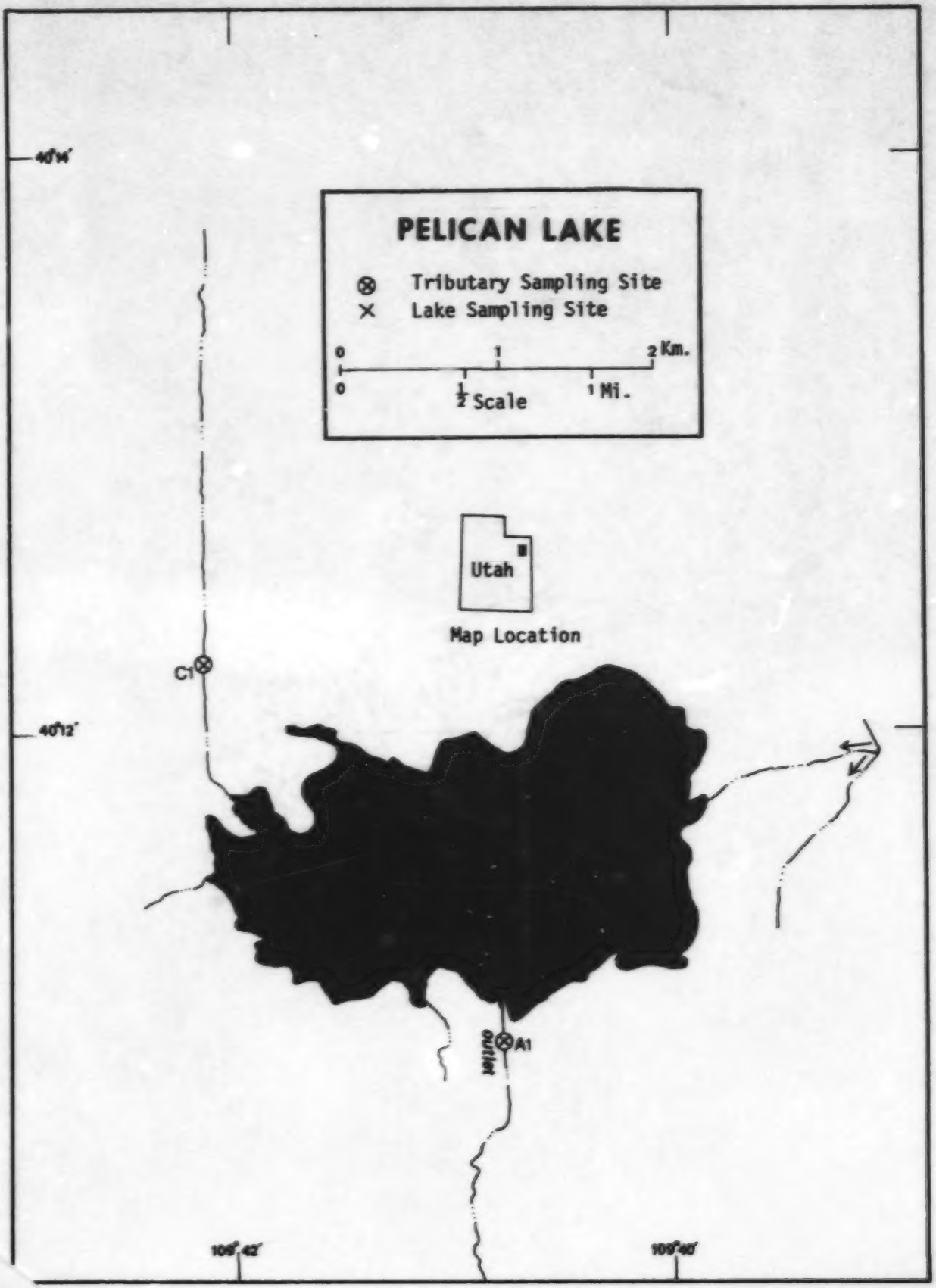
Major General Maurice L. Watts, the Adjutant General of Utah, and Project Officer Lt. Colonel T. Ray Kingston, who directed the volunteer efforts of the Utah National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES AND RESERVOIRS

STATE OF UTAH

NAME	COUNTY
Bear	Rich, UT; Bear Lake, ID
Deer Creek	Wasatch
Echo	Summit
Fish	Sevier
Flaming Gorge	Daggett, UT; Sweetwater, WY
Huntington	Emery
Joes Valley	Emery
Lower Bowns	Garfield
Lynn	Box Elder
Minersville	Beaver
Moon	Duchesne
Navajo	Kane
Newcastle	Iron
Otter Creek	Piute
Panguich	Garfield
Pelican	Uintah
Pineview	Weber
Piute	Piute
Porcupine	Cache
Powell	Garfield, Kane, San Juan, UT; Coconino, AZ
Pruess	Millard
Sevier Bridge	Juab, Sanpete
Starvation	Duchesne
Steinaker	Uintah
Tropic	Garfield
Utah	Utah
Willard Bay	Box Elder


PELICAN LAKE
Tributary Sampling Site
Lake Sampling Site
0
1
2 Km.
0
1/2 Scale
1 Mi.
Utah
Map Location
C1
A1
outlet
40°14'
40°12'
109°42'
109°40'

PELICAN LAKE

STORET NO. 4915

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Pelican Lake is eutrophic. It ranked twelfth in overall trophic quality when the 27 Utah lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. Sixteen of the water bodies had less and one had the same median total phosphorus, five had less and two had the same median dissolved orthophosphorus, 12 had less and one had the same median inorganic nitrogen, 12 had less mean chlorophyll a, and 17 had greater mean Secchi disc transparency.

Survey limnologists observed extensive growths of submerged macrophytes each sampling visit, and the numbers of phytoplankton in the September sample (page 6) indicate a bloom was in progress at that time.

B. Rate-Limiting Nutrient:

The algal assay results indicate phosphorus was limiting at the time the sample was collected (09/23/75).

The lake data indicate phosphorus limitation in August and September but nitrogen limitation in May.

C. Nutrient Controllability:

1. Point sources--No known point sources impacted Pelican Lake during the sampling year.

* See Appendix A.

2. Non-point sources--More than 84% of the total phosphorus load reaching Lake Pelican during the year of sampling was contributed by the gaged tributaries. The ungaged tributaries were estimated to have contributed 2.2% of the total phosphorus load. The present loading of 0.13 g/m^2/year is just over two times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11).

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 6.88 kilometers^2.
2. Mean depth: 3.0 meters.
3. Maximum depth: 5.5 meters.
4. Volume: 20.895 x 10^6 m^3.
5. Mean hydraulic retention time: 36.8 years (based on outflow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Unnamed Canal C-1	0.0	0.123
Minor tributaries & immediate drainage -	19.0	0.003
Totals	19.0	0.126

2. Outlet -

Unnamed Canal A-1	25.9**	0.018**

C. Precipitation***:

1. Year of sampling: 18.1 centimeters.
2. Mean annual: 18.9 centimeters.

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† Table of metric conversions--Appendix B.
†† Sudweeks, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake; lesser outflow due to irrigation withdrawal and evaporation.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Pelican Lake was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two or more depths at two stations on the lake (see map, page v). During each visit, a single depth-integrated (near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the September visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depth sampled at each station was 2.4 meters.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR PELICAN LAKE
STORET CODE 4915

PARAMETER	1ST SAMPLING (5/13/75) 2 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (8/ 7/75) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/23/75) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	12.1 - 13.5	12.9	13.0	21.6 - 23.7	22.2	22.1	17.5 - 18.4	17.9	17.8
DISS OXY (MG/L)	8.0 - 10.0	9.3	9.7	8.9 - 11.2	10.0	9.9	6.6 - 7.4	7.1	7.1
CNDCTVY (MCROMO)	775. - 800.	790.	793.	1146. - 1250.	1199.	1199.	891. - 919.	900.	897.
PH (STAND UNITS)	8.8 - 8.9	8.9	8.9	8.9 - 9.6	9.3	9.2	9.1 - 9.4	9.3	9.2
TOT ALK (MG/L)	230. - 294.	260.	258.	196. - 298.	247.	248.	258. - 378.	303.	299.
TOT P (MG/L)	0.032 - 0.046	0.037	0.036	0.035 - 0.045	0.039	0.037	0.044 - 0.068	0.055	0.053
ORTHO P (MG/L)	0.006 - 0.018	0.014	0.015	0.004 - 0.008	0.006	0.005	0.002 - 0.003	0.002	0.002
NO2+NO3 (MG/L)	0.020 - 0.020	0.020	0.020	0.020 - 0.020	0.020	0.020	0.020 - 0.020	0.020	0.020
AMMONIA (MG/L)	0.030 - 0.050	0.037	0.035	0.040 - 0.100	0.075	0.080	0.020 - 0.020	0.020	0.020
KJEL N (MG/L)	0.600 - 0.800	0.725	0.750	0.700 - 0.900	0.825	0.850	1.000 - 1.400	1.200	1.200
INORG N (MG/L)	0.050 - 0.070	0.057	0.055	0.060 - 0.120	0.095	0.100	0.040 - 0.040	0.040	0.040
TOTAL N (MG/L)	0.620 - 0.820	0.745	0.770	0.720 - 0.920	0.845	0.870	1.020 - 1.420	1.220	1.220
CHLRPYL A (UG/L)	0.8 - 1.4	1.1	1.1	4.8 - 5.3	4.6	4.6	13.2 - 13.4	13.3	13.3
SECCHI (METERS)	****** - ******			1.8 - 2.1	2.0	2.0	0.8 - 1.5	1.1	1.1

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/13/75	1. Chlamydomonas sp.	801
	2. Fragilaria sp.	616
	3. Chroomonas sp.	493
	4. Cryptomonas sp.	246
	5. Scenedesmus sp.	62
	Total	2,218
08/07/75	1. Tetraedron sp.	376
	2. Fragilaria sp.	282
	3. Chroomonas sp.	235
	4. Cryptomonas sp.	188
	5. Oocystis sp.	141
	Other genera	377
	Total	1,599
09/23/75	1. Chlorophytan cells	70,495
	2. Microcystis sp.	2,287
	3. Dactylococcopsis sp.	1,334
	4. Merismopedia sp.	953
	5. Oscillatoria sp.	667
	Other genera	284
	Total	76,020

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/13/75	1	1.4
	2	0.8
08/07/75	1	5.3
	2	4.0
09/23/75	1	13.4
	2	13.2

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.010	0.140	1.9
0.050 P	0.060	0.140	7.5
0.050 P + 1.0 N	0.060	1.140	24.0
1.0 N	0.010	1.140	1.6

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Pelican Lake was moderately high at the time the sample was collected (09/23/75). Also, the significant increase in yield with the addition of orthophosphorus only, and the lack of increase when only nitrogen was added, indicate phosphorus limitation at that time.

The lake data indicate phosphorus limitation in August and September (the mean inorganic nitrogen/orthophosphorus ratios were 16/1 and 20/1, respectively) but nitrogen limitation in May (the mean N/P ratio was 4/1).

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Utah National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the months of April, May, and June when two samples were collected. Sampling was begun in November, 1974, and was completed in August, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Utah District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the mean concentrations in the unnamed canal at station C-1 and the mean annual ZZ flow.

No known wastewater treatment plants impacted Pelican Lake during the year of sampling.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source		kg P/yr	% of total
a.	Tributaries (non-point load) -		
	Unnamed Canal C-1	775	84.7
b.	Minor tributaries & immediate drainage (non-point load) -	20	2.2
c.	Known municipal STP's -	None	-
d.	Septic tanks - Unknown -	?	-
e.	Known industrial -	None	-
f.	Direct precipitation* -	120	13.1
	Total	915	100.0

2. Outputs -

Lake outlet -	Unnamed Canal A-1	45

3. Net annual P accumulation - 870 kg.

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Unnamed Canal C-1	0.200	1.609
Unnamed Canal A-1	0.080	1.233

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Unnamed Canal C-1	6,240	45.2
b. Minor tributaries & immediate drainage (non-point load) -	150	1.1
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation* -	7,430	53.7
Total	13,820	100.0

2. Outputs -

Lake outlet - Unnamed Canal A-1	700	

3. Net annual N accumulation - 13,120 kg.

D. Mean Nutrient Concentrations in Sampled Streams:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Unnamed Canal C-1	0.200	1.609
Unnamed Canal A-1	0.080	1.233

* See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.13	0.12	2.0	1.9

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Pelican Lake:

"Dangerous" (eutrophic loading)	0.06
"Permissible" (oligotrophic loading)	0.03

V. LITERATURE REVIEWED

Sudweeks, Calvin K., 1975. Personal communication (lake morphometry). UT Bur. of Env. Health, Salt Lake City.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
0408	LAKE POWELL	0.010	0.410	339.830	3.081	13.800	0.007
4901	BEAR LAKE	0.011	0.040	253.167	0.945	9.200	0.003
4902	LOWER BOWN'S RESERVOIR	0.031	0.040	336.000	5.567	9.400	0.006
4903	DEER CREEK RESERVOIR	0.038	0.215	430.333	9.078	14.800	0.006
4904	ECHO RESERVOIR	0.047	0.170	450.333	6.967	14.000	0.012
4905	LYNN RESERVOIR	0.121	0.200	417.667	39.600	10.400	0.052
4906	FISH LAKE	0.023	0.040	152.000	12.483	10.400	0.004
4907	HUNTINGTON NORTH RESERVO	0.013	0.040	392.000	1.980	7.800	0.005
4908	JOE'S VALLEY RESERVOIR	0.012	0.045	400.000	2.483	11.200	0.003
4909	MINERSVILLE RESERVOIR	0.192	0.060	445.000	33.583	8.600	0.107
4910	MOON LAKE	0.008	0.040	381.000	2.700	9.600	0.002
4911	NAVAJO LAKE	0.016	0.040	368.000	2.000	6.000	0.003
4912	NEWCASTLE RESERVOIR	0.051	0.040	428.667	12.467	13.600	0.009
4913	OTTER CREEK RESERVOIR	0.067	0.040	453.667	11.767	10.600	0.033
4914	PANGUITCH LAKE	0.071	0.040	426.500	45.950	14.200	0.010
4915	PELICAN LAKE	0.044	0.050	438.500	6.350	8.400	0.004
4916	PINEVIEW RESERVOIR	0.028	0.300	435.083	5.692	14.600	0.006
4917	PIUTE RESERVOIR	0.047	0.150	482.625	25.329	11.600	0.007
4918	PORCUPINE RESERVOIR	0.025	0.110	440.000	7.860	12.400	0.011
4919	PRUESS RESERVOIR (GARRIS	0.057	0.140	491.000	4.533	8.800	0.008
4920	SEVIER BRIDGE RESERVOIR	0.026	0.355	449.778	18.222	12.400	0.008
4921	STARVATION RESERVOIR	0.016	0.040	394.583	5.675	13.200	0.004
4922	STEINAKER RESERVOIR	0.011	0.040	316.750	1.844	12.600	0.005
4923	TROPIC RESERVOIR	0.021	0.050	425.000	7.200	8.400	0.006
4924	UTAH LAKE	0.132	0.320	490.583	72.012	11.400	0.012
4925	WILLARD BAY RESERVOIR	0.044	0.060	457.182	7.567	11.000	0.009
5605	FLAMING GORGE RESERVOIR	0.011	0.690	285.636	2.500	10.400	0.003

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
0408	LAKE POWELL	96 (25)	4 (1)	81 (21)	73 (19)	15 (4)	42 (11)	311
4901	BEAR LAKE	90 (23)	87 (19)	96 (25)	100 (26)	77 (20)	90 (23)	540
4902	LOWER BOWN'S RESERVOIR	46 (12)	87 (19)	85 (22)	65 (17)	73 (19)	50 (13)	406
4903	DEER CREEK RESERVOIR	42 (11)	19 (5)	42 (11)	35 (9)	0 (0)	58 (14)	196
4904	ECHO RESERVOIR	31 (8)	27 (7)	19 (5)	50 (13)	12 (3)	13 (3)	152
4905	LYNN RESERVOIR	8 (2)	23 (6)	58 (15)	8 (2)	62 (15)	4 (1)	163
4906	FISH LAKE	62 (16)	65 (16)	100 (26)	23 (6)	62 (15)	79 (20)	391
4907	HUNTINGTON NORTH RESERVO	77 (20)	65 (16)	69 (18)	92 (24)	96 (25)	69 (18)	468
4908	JOE'S VALLEY RESERVOIR	81 (21)	58 (15)	62 (16)	85 (22)	46 (12)	96 (25)	428
4909	MINERSVILLE RESERVOIR	0 (0)	44 (11)	27 (7)	12 (3)	85 (22)	0 (0)	168
4910	MOON LAKE	100 (26)	87 (19)	73 (19)	77 (20)	69 (18)	100 (26)	506
4911	NAVAJO LAKE	69 (18)	87 (19)	77 (20)	88 (23)	100 (26)	85 (22)	506
4912	NEWCASTLE RESERVOIR	23 (6)	87 (19)	46 (12)	27 (7)	19 (5)	27 (7)	229
4913	OTTER CREEK RESERVOIR	15 (4)	87 (19)	15 4)	31 (8)	54 (14)	8 (2)	210
4914	PANGUITCH LAKE	12 (3)	65 (16)	50 (13)	4 (1)	8 (2)	23 (6)	162
4915	PELICAN LAKE	37 (9)	54 (14)	35 (9)	54 (14)	90 (23)	73 (19)	343
4916	PINEVIEW RESERVOIR	50 (13)	15 (4)	38 (10)	58 (15)	4 (1)	58 (14)	223
4917	PIUTE RESERVOIR	27 (7)	31 (8)	8 (2)	15 (4)	38 (10)	46 (12)	165
4918	PORCUPINE RESERVOIR	58 (15)	38 (10)	31 (8)	38 (10)	33 (8)	19 (5)	217
4919	PRUESS RESERVOIR (GARRIS	19 (5)	35 (9)	0 (0)	69 (18)	81 (21)	37 (9)	241
4920	SEVIER BRIDGE RESERVOIR	54 (14)	8 (2)	23 (6)	19 (5)	33 (8)	37 (9)	174
4921	STARVATION RESERVOIR	73 (19)	87 (19)	65 (17)	62 (16)	23 (6)	79 (20)	389
4922	STEINAKER RESERVOIR	85 (22)	87 (19)	88 (23)	96 (25)	27 (7)	65 (17)	448
4923	TROPIC RESERVOIR	65 (17)	50 (13)	54 (14)	46 (12)	90 (23)	58 (14)	363
4924	UTAH LAKE	4 (1)	12 (3)	4 (1)	0 (0)	42 (11)	13 (3)	75
4925	WILLARD BAY RESERVOIR	37 (9)	44 (11)	12 (3)	42 (11)	50 (13)	31 (8)	216
5605	FLAMING GORGE RESERVOIR	90 (23)	0 (0)	92 (24)	81 (21)	62 (15)	90 (23)	415

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4901	BEAR LAKE	540
2	4911	NAVAJO LAKE	506
3	4910	MOON LAKE	506
4	4907	HUNTINGTON NORTH RESERVO	468
5	4922	STEINAKER RESERVOIR	448
6	4908	JOE'S VALLEY RESERVOIR	428
7	5605	FLAMING GORGE RESERVOIR	415
8	4902	LOWER BOWN'S RESERVOIR	406
9	4906	FISH LAKE	391
10	4921	STARVATION RESERVOIR	389
11	4923	TROPIC RESERVOIR	363
12	4915	PELICAN LAKE	343
13	0408	LAKE POWELL	311
14	4919	PRUESS RESERVOIR (GARRIS	241
15	4912	NEWCASTLE RESERVOIR	229
16	4916	PINEVIEW RESERVOIR	223
17	4918	PORCUPINE RESERVOIR	217
18	4925	WILLARD BAY RESERVOIR	216
19	4913	OTTER CREEK RESERVOIR	210
20	4903	DEER CREEK RESERVOIR	196
21	4920	SEVIER BRIDGE RESERVOIR	174
22	4909	MINERSVILLE RESERVOIR	168
23	4917	PIUTE RESERVOIR	165
24	4905	LYNN RESERVOIR	163
25	4914	PANGUITCH LAKE	162
26	4904	ECHO RESERVOIR	152
27	4924	UTAH LAKE	75

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR UTAH 10/18/76

LAKE CODE 4915 PELICAN LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 25.9

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4915A1	25.9	0.0	0.0	0.0	0.0	0.028	0.057	0.057	0.057	0.014	0.0	0.0	0.0	0.018
4915C1	0.0	0.142	0.057	0.085	0.142	0.142	0.057	0.057	0.0	0.0	0.085	0.425	0.283	0.123
4915ZZ	25.9	0.0	0.0	0.003	0.003	0.008	0.006	0.006	0.003	0.003	0.0	0.0	0.0	0.003

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 25.9
SUM OF SUB-DRAINAGE AREAS = 25.9
TOTAL FLOW IN = 1.50
TOTAL FLOW OUT = 0.21

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4915A1	11	74	0.0	9	0.0				
	12	74	0.0	15	0.0				
	1	75	0.0	12	0.0				
	2	75	0.0	8	0.0				
	3	75	0.0	8	0.0				
	4	75	0.006	5	0.0				
	5	75	0.028	2	0.023	18	0.028		
	6	75	0.042	7	0.042	22	0.042		
	7	75	0.142	14	0.142				
	8	75	0.170	16	0.170				
	9	75	0.057						
	10	75	0.0						
4915C1	11	74	0.425						
	12	74	0.425						
	1	75	0.0						
	2	75	0.0						
	3	75	0.142						
	4	75	0.283						
	5	75	0.283						
	6	75	0.057						
	7	75	0.028						
	8	75	0.0						
	9	75	0.0						
	10	75	0.057						
4915ZZ	11	74	0.0						
	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.003						
	4	75	0.003						
	5	75	0.006						
	6	75	0.008						
	7	75	0.008						
	8	75	0.006						
	9	75	0.006						
	10	75	0.0						

APPENDIX C
DATA FLOW DIAGRAM

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/12

491501
40 11 27.0 109 41 18.0 3
PELICAN LAKE
49047 UTAH

110691

11EPALES 2111202
0012 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/13	11	45 0000	12.8	9.6		786	8.95	294	0.040	0.800	0.020K	0.018
	11	45 0008	12.1	10.0		775	8.95	258	0.030	0.600	0.020K	0.017
75/08/07	10	10 0000	21.2	10.8	84	1150	8.95	298	0.070	0.700	0.020K	0.005
	10	10 0006	21.0	11.2		1146	8.95	298	0.040	0.800	0.020K	0.004
75/09/23	15	15 0000	17.8	7.0	30	904	9.10	298	0.020K	1.000	0.020K	0.002
	15	15 0005	17.5	6.6		894	9.10	300	0.020K	1.200	0.020K	0.002
	15	15 0008	17.5	7.0		895	9.10	312	0.020K	1.400	0.020K	0.002

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/13	11	45 0000	0.032	1.4	
	11	45 0008	0.036		
75/08/07	10	10 0000	0.045	5.3	
	10	10 0006	0.039		
75/09/23	15	15 0000	0.044	13.4	
	15	15 0005	0.061		
	15	15 0008	0.068		

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 75/08/12

491502
40 11 33.0 109 40 15.0 3
PELICAN LAKE
49047 UTAH

110691

11EPALES
0008 FEET DEPTH 2111202 CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/13	12 05	0000	13.5	9.8		800	8.85	230	0.050	0.800	0.020K	0.006
	12 05	0005	13.2	8.0		800	8.85	258	0.030	0.700	0.020K	0.014
75/08/07	10 30	0000	23.7	8.9		1250	9.50	197	0.090	0.900	0.020K	0.006
	10 30	0005	23.1	9.0	72	1248	9.65	196	0.100	0.900	0.020K	0.008
75/09/23	15 40	0000	18.4	7.4		919	9.40	378	0.020K	1.200	0.020K	0.002
	15 40	0005	18.4	7.3	60	899	9.45	258	0.020	1.200	0.020K	0.002
	15 40	0008	17.8	7.4		891	9.45	270	0.020	1.200	0.020K	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT HENNING PERCENT
75/05/13	12 05	0000	0.046	0.8	
	12 05	0005	0.036	4.0	
75/08/07	10 30	0000	0.036	13.2	
	10 30	0005	0.035		
75/09/23	15 40	0000	0.048		
	15 40	0005	0.054		
	15 40	0008	0.053		

K VALUE KNOWN TO BE LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 75/08/12

491SA1
40 10 55.0 109 40 50.0 4
UNNAMED CREEK
49 7.5 PELICAN LAKE
O/PELICAN LAKE 110691
BNK 100 FT OF END UNT RD 1.8 M WSW LEOTA
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/04/05	09	30	1.400	0.700	0.065	0.090	0.160
75/05/02	17	05	0.005	1.100	0.020	0.015	0.050
75/05/18	11	30	0.005	1.050	0.012	0.012	0.050
75/06/07	13	00	0.005	0.900	0.020	0.010	0.040
75/06/22	18	30	0.005	1.050	0.020	0.005K	0.030
75/07/14	08	00	0.005	1.250	0.020	0.060	0.210
75/08/16	18	00	0.005	1.150	0.015	0.005	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

491SC1
40 12 27.0 109 42 06.0 4
UNNAMED CREEK
49 7.5 PELICAN LAKE
T/PELICAN LAKE 110691
BRDG ON LGHT DTY RD 2 M # OF JCT # HT 88
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/09	11	10	0.040	1.100	0.027	0.022	
74/12/15	09	10	0.176	0.700	0.020	0.005	0.070
75/03/08	12	30	0.164	1.500	0.016	0.018	
75/04/05	09	25	1.880	0.087	0.060	0.065	0.070
75/04/06	08	45	0.005	1.950	0.070	0.015	0.080
75/05/02	17	00	0.650	1.150	0.035	0.005	0.060
75/05/18	11	50	0.400	0.750	0.030	0.010	0.060
75/06/22	18	00	0.085	1.250	0.030	0.095	0.780
75/07/14	08	15	0.095	2.500	0.020	0.030	0.280